

Carbon Capture Technology

THE global community is dealing with an unparalleled climate crisis, with carbon emissions significantly exacerbating the situation. To alleviate the consequences of climate change, it is imperative to decrease the quantity of carbon emissions originating from diverse sources.

Carbon capture technologies provide exceptional solutions to this issue. By capturing carbon dioxide (CO₂) from industrial activities or directly from the atmosphere and subsequently storing it, these technologies can prevent significant quantities of greenhouse gas emissions from being released into the atmosphere, thus mitigating their contribution to global warming.

Carbon capture technology has been developed to lessen the impact of human-caused climate change. As the world's average temperature continues to climb, this is a fantastic way to combat this pressing issue.

Various sources, including power plants, factories, and natural gas processing plants, can absorb carbon dioxide (CO₂) through carbon capture, utilisation, and storage (CCUS). Transporting and storing the collected CO₂ in subterranean geological formations is possible.

A handful of the many options available for mitigating the effects of climate change and capturing carbon emissions are as follows.

Enhanced Rock Weathering (ERW)

ERW involves the utilisation of pulverised silicate minerals and rocks, such as basalt and glauconite, and the subsequent application of the resulting substance onto the soil.

This massive rock dust will react with CO₂ in rainwater to form stable carbonates before it is sedimented into the ocean. This technology expedites the inherent process of weathering that typically takes place over millions of years while simultaneously augmenting the quantity of CO₂ sequestered by the soil.

An essential benefit of this technology is its high efficiency, which also contributes to cost savings. Additionally, it has the advantage of enhancing soil fertility.

However, the major challenge of this technology is sourcing and grinding the rocks into their optimal size for its mass application.

Gas Separation Using Membranes

Membrane gas separation

technology employs permeable materials to separate carbon dioxide and other gases. Due to its operation at low temperatures and pressures, it exhibits high energy efficiency and cost-effectiveness.

Although membrane gas separation technology is currently in the experimental phase, it shows significant potential in capturing, separating, and storing CO₂.

Carbon Capture in Power Plants

This technology captures carbon emissions from power plants before their release into the atmosphere. Subsequently, the carbon dioxide (CO₂) is subjected to compression and subsequently conveyed for storage or utilised for enhanced oil recovery.

Despite its limitations, this technology is presently the most extensively employed method for carbon capture, and its widespread implementation has the potential to make a substantial impact in reducing carbon emissions.

CO₂ Capture Using Aqueous Amine Solutions

This technology utilises amines to capture and sequester CO₂ from industrial processes before its emission into the atmosphere.

The carbon dioxide (CO₂) is subsequently isolated from the amine and conveyed for storage or reuse. Despite the maturity of this technology, it is constrained by its high energy consumption and costly



CARBON STORIES

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nature.

Direct Air Capture (DAC)

DAC refers to the process of removing carbon dioxide directly from the atmosphere. This technology employs air filters to capture carbon dioxide from the atmosphere directly.

Once the CO₂ is gathered, it is condensed and conveyed for storage or conversion into valuable commodities such as producing cement, and synthetic fuels, using the stored CO₂ for plant growth in greenhouse agriculture.

Despite being in its nascent phase and having a high cost, DAC exhibits significant potential in reducing carbon emissions from the atmosphere, which can be further realised through research and scaling.

Chemical Looping

It is a process that involves using

chemicals to facilitate the conversion of substances.

This technology utilises metal-based particles in a chemical reaction with carbon dioxide. The metals function as a catalyst, facilitating carbon dioxide separation from the fuel.

Subsequently, the carbon dioxide (CO₂) is captured and stored, while the fuel is retained for subsequent combustion.

Chemical looping technology is currently in the experimental phase. However, it exhibits the potential to mitigate carbon emissions from industries that heavily depend on fossil fuels.

Cryogenic Carbon Capture (CCC)

CCC is an emerging carbon capture technology that uses cryogenic cooling to capture and eliminate CO₂ from gas streams effectively.

This system has a higher CO₂ extraction rate than conventional systems and can store it in a smaller volume.

While utilising CCC is currently restricted, as technology advances, it demonstrates significant promise in reducing carbon emissions from diverse origins.

Nanotechnology for Carbon Capture

This technology utilises nanomaterials, specifically carbon nanotubes, to efficiently capture and store carbon dioxide at significantly

reduced pressures compared to alternative methods.

This method employs fewer resources and energy, resulting in lower waste production than alternative carbon capture technologies.

Despite being in the experimental phase, carbon capture through nanotechnology shows excellent potential due to its ability to be scaled up and its high efficiency.

Bioenergy with Carbon Capture and Storage (BECCS)

This technology involves using biomass to generate energy while capturing and storing the carbon dioxide emissions produced.

BECCS is a process that entails capturing and storing carbon dioxide emitted during biomass energy production.

The process captures emissions and produces electricity, making it carbon-negative.

Bioenergy with carbon capture and storage is an energy source with low carbon emissions that can substantially reduce carbon dioxide in the economy.

Each of these technologies possesses unique benefits and constraints, which render one or the other more appropriate for varying scenarios.

Nevertheless, their shared characteristic lies in their ability to serve as a crucial tool in mitigating the release and accumulation of greenhouse gases, which pose a significant risk to humanity's long-term existence.

In conclusion, carbon capture technology stands out as a vital tool in our fight against climate change.

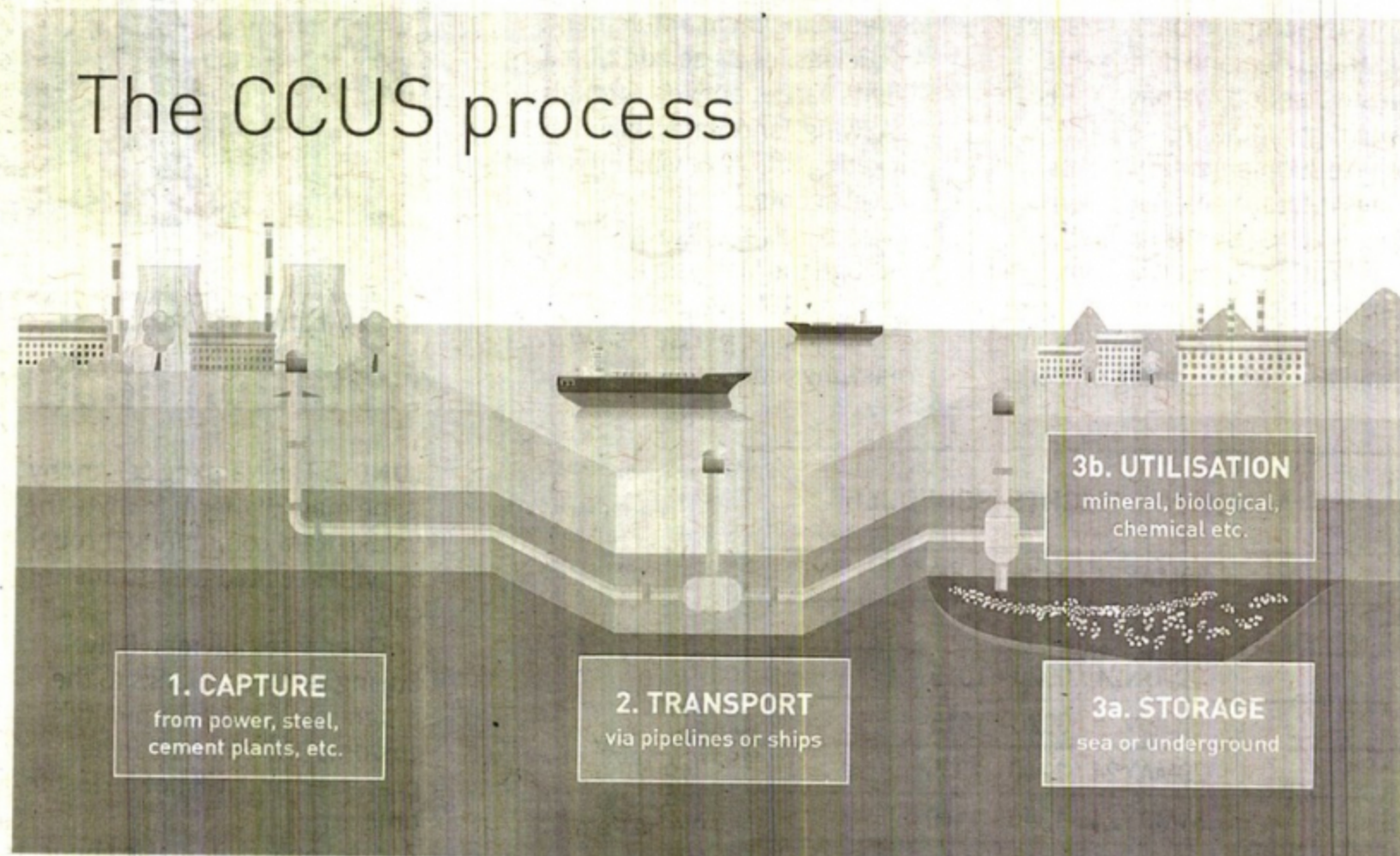
By capturing and storing carbon dioxide from various sources, such as industrial activities and the atmosphere, these technologies help reduce greenhouse gas emissions significantly.

From enhanced rock weathering to direct air capture and cryogenic carbon capture, each method offers unique benefits and challenges.

Despite being at different stages of development and implementation, all these technologies share the common goal of mitigating the adverse effects of carbon emissions.

As research and innovation continue to advance, carbon capture technologies hold great promise for creating a more sustainable and environmentally friendly future.

The views expressed here are those of the writer and do not necessarily represent the views of the New Sarawak Tribune.



SOURCE: International Association of Oil and Gas Producers